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Confidence of nurses with inhaler device education and competency of device use in a specialised respiratory inpatient unit

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Abstract

We performed a cross-sectional study within a specialised respiratory inpatient unit assessing 25 nurses' [85% female, 8.0 ± 7.9 (mean ± SD) years' experience in nursing] confidence in providing inhaler device education using a self-reported questionnaire, and their competency (% correct steps) in using eight different inhaler devices. Sixteen percent of participants were 'not confident' providing inhaler education, while 84% were 'moderately' or 'extremely' confident. The mean (±SD)% correct steps for all devices was 47 ± 17%. There was no correlation between % correct steps and nursing years ($r = 0.21$, $p = 0.31$), or 'confidence' with providing inhaler education ($r = 0.02$, $p = 0.91$) but % correct steps strongly correlated with number of individual device prescriptions within the hospital in the preceding year ($r = 0.78$, $p = 0.039$). Most respiratory nurses felt confident in teaching inhaler technique but their overall demonstrated ability to correctly use inhalers was poor, especially for less frequently prescribed devices within our hospital. Regular assessment and ongoing education on correct inhaler technique for respiratory nurses is necessary to optimise all device usage by nurses, irrespective of experience or confidence.

Keywords

COPD, metered dose inhalers, dry powder inhalers, clinical nursing research, respiratory nurses

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Introduction

Inhaled bronchodilators and inhaled steroid medications are important components in the management of asthma and chronic obstructive pulmonary disease (COPD).[1] However, the effectiveness of inhaled medications is dependent on patients using their inhalers correctly, which differs from oral medications which only require simple ingestion. Inhaler devices may be difficult to use for patients, and there is extensive evidence demonstrating that many patients have inhalation technique errors resulting in ineffective drug delivery,[2,3] a problem that has persisted for over four decades.[4,5] Systematic reviews have demonstrated

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that only 31% of patients have correct inhaler technique, 41% have acceptable inhaler technique and 31% have poor inhaler technique with pressurised metered dose inhaler or dry powder inhalers.[6] Overall, more than 75% of patients use pressurised metered dose inhalers (pMDI) incorrectly.[7] Failure to perform the correct sequence of steps required for inhaler devices may result in poorer control of symptoms, increasing the risk of hospital readmissions, morbidity and mortality as well as raising healthcare costs.[6,8] Critical errors in inhaler use have been shown to increase the risk of severe exacerbations of COPD resulting in hospitalisation or emergency room visits.[5]

In the acute care setting, the correct use of bronchodilators via pMDI and spacers in patients hospitalised for exacerbations of their airways disease has never been more important in the current COVID-19 climate because of the potential for viral particle aerosolisation from nebulisers.[9,10] Other advantages of using pMDI and spacers in the acute hospital setting include the opportunity for healthcare professionals to provide pMDI training to patients,[11] reducing the risk of increased side effects such tachycardia and tremors which has been associated with the use of nebulisers, and delivering effective treatment via a portable, more cost-effective system in a shorter period of time.[12,13] For all of these reasons, education in the correct use of inhaler devices by clinicians competent in inhaler technique is essential in optimising drug delivery.[14]

International guidelines for asthma and COPD recommend regularly checking patients' inhaler technique to educate and correct any errors.[1,2] However, the growth in the number and variety of inhaler devices has likely resulted in greater difficulty in correctly demonstrating and using these devices, both for patients and clinicians. A recent systematic review of inhaler technique studies in patients has reported frequent error rates with no apparent improvement over a 40 year period,[6] and another systematic review demonstrated that all subgroups of health care professionals (including physicians, respiratory therapists, nurses and pharmacists) also have high error rates in the use of these devices which has been known since 1984.[15] A small study of 16 nurses and 11 pharmacists in an Australian respiratory ward revealed that no one in either group was able to correctly demonstrate pMDI with spacer or a Turbuhaler.[16] However as nurses working in a specialised respiratory ward are involved with regularly administering and supervising inhaler therapy, we hypothesised that inhaler technique competency within this specialised nursing population would correlate with years of nursing experience as well as confidence in delivering inhaler education to patients.

Aim

The aim of our study was to assess the competence of nurses working on a specialised respiratory ward in a quaternary university teaching hospital in the usage of 8 different inhaler devices, and whether years of nursing experience, self-perceived confidence with teaching inhaler technique and number of hospital prescriptions for each device in the preceding year were factors associated with an increase in competence. Furthermore, we explored barriers to providing inhaler technique education to patients, and nurses' preferences for ongoing education in this area.

Methods

This cross-sectional study was undertaken at Westmead Hospital in Western Sydney, Australia between March 2016 and June 2016. Westmead Hospital is a 975 bed University of Sydney quaternary teaching hospital in the Western Sydney Local Health District with a 28-bed inpatient respiratory unit which has 600 to 700 admissions due to COPD exacerbations per year. We approached eligible nurses who were working in the inpatient respiratory unit at regular respiratory ward meetings to participate in our study. The study was conducted either during or after the nurse's shift, taking approximately 30 minutes for the inhaler device assessment. Written informed consent was obtained from participants before enrolment. The study was approved by the Human Research Ethics Committee of the Western Sydney Local Health District (LNR/16/WMED/61).

In order to assess participants' self-reported confidence with inhaler therapy education, we developed a self-administered survey for this study (investigators VS and MR). The survey consisted of 8 items which asked various questions about inhaler technique/education (see Online Appendix A). Competence with inhaled therapy was assessed by the investigators who were expert assessors (VS or MR) using a checklist of steps recommended by Lung Foundation Australia.[17] Nurses who had already participated were requested to not inform their colleagues about the content of the questionnaire and assessment to minimise response bias. All data were de-identified prior to analysis.

Questionnaire

We collected demographic data including age, gender and number of years working both in nursing and more specifically, within respiratory nursing. Participants were then asked to rate their confidence in providing inhaler device education to patients (see online supplement A). In addition, we assessed perceived barriers to nurses providing inhaler education and what kind of assistance could be provided to enhance participants' ability to provide inhaler education to their patients.

Competency assessment

After answering the questionnaire, participants undertook a competency assessment of inhaler technique. Participants were provided with various placebo devices and asked to demonstrate the use of each device as if demonstrating it to a patient. Participants were requested to select inhaler devices in random order and to demonstrate correct technique. The devices assessed were Accuhaler, Breezhaler, Ellipta, Genuair, Handihaler, pressurised metered dose inhaler (pMDI) and spacer device, Respimat and Turbuhaler. In keeping with our local hospital policy of not using pMDIs alone in the ward, we did not assess pMDIs without a spacer. There was a discussion with participants regarding priming various devices before use but this step was not scored as it was not included in the individual inhaler checklists.

Participants were assessed by one assessor (either MR or VS). Both assessors were Clinical Nurse Consultants in Respiratory Medicine and very familiar with inhaler technique as they were regularly involved in training nurses and other healthcare professionals in correct inhaler usage based on Lung Foundation Australia recommendations as well as undergoing regular training and assessment with specialists within the field. To ensure consistency, both assessors (VS and MR) used a checklist of the correct steps for inhaler use obtained from Lung Foundation Australia.[17] Assessors recorded if participants correctly undertook each step correctly. Participants' scores were calculated by assessing the number of correct steps in correct order, divided by the total number of steps multiplied by 100 to express as a percentage. For the purpose of this study, each step was given equal weight and the participants needed to clearly demonstrate all steps correctly and in order to score 100% as there is currently no consensus regarding the number of correct steps required to be deemed competent, or agreement of the definition of 'critical' versus 'non-critical' errors.[18,19]

Hospital inhaler device usage

We obtained monthly inpatient hospital inhaler prescription data from pharmacy dispensing and distribution records for the 12 months prior to study initiation (January 2015 to December 2015) to demonstrate the frequency of device usage on the hospital wards prior to the study period. Respimat data were not available from pharmacy records in 2015 because it had not been on the hospital formulary in the year preceding our study as it had only been available for use in Australia from 1st October 2015.

Data analysis

We reported categorical data as frequencies (%) and continuous variables as mean and standard deviation. We confirmed that continuous data were normally distributed using the Shapiro-Wilk test. Participants were grouped into tertiles based on years of nursing experience at the time of the study. We compared total inhaler technique scores between tertile groups with one-way ANOVA. We used Pearson's correlation coefficient to measure the strength of association between years of experience and % correct technique (all devices), number of inpatient inhaler devices prescribed in 2015 with % correct technique for each device, and used Spearman's correlation coefficient for participants' confidence and % correct technique. Data were analysed using SPSS for Windows, version 22 (IBM Corp., Armonk, N.Y., USA) and Prism version 5 (Graphpad Software, San Diego, CA, USA). Statistical significance was set at $p \leq 0.05$.

Results

Demographics

Of the 37 nurses working on respiratory wards over a four-month period at the time of the study, 25 (68%) agreed to participate. Participants reported an average of 8.0 $\pm$ 7.9 (mean $\pm$ SD) years of experience in nursing, and 4.4 $\pm$ 5.3 years of experience in respiratory nursing. There were 17 Registered Nurses (8.1 $\pm$ 7.5 years' experience), 5 Enrolled Nurses (1.8 $\pm$ 1.1 years' experience), two Clinical Nurse Specialists and a Clinical Nurse Educator (18.3 $\pm$ 5.8 years' experience; see Online Appendix C for definitions). The first tertile of participants had less than 3 years of nursing experience (n = 8), the

Table 1. Pre-assessment questionnaire for 25 participants.

	%
Should patients be supervised taking inhaled medications?	
Yes	96%
How often?	
Once/day	32%
Twice/day	8%
Every time	60%
Who should supervise?	
Clinical Nurse Consultants only	8%
All nurses	92%
Do you feel there is sufficient resource on the ward to equip you with good knowledge and understanding of inhaler technique?	
Yes	64%
No	36%
How confident are you in providing inhaler education?	
Not at all	16%
Moderately confident	76%
Extremely confident	8%
What do you feel are the barriers to providing inhaler education to COPD patients? (please circle all that are applicable)	
Not enough time	24%
Not enough knowledge	28%
Not enough confidence	4%
Not enough time/confidence	4%
Not enough time/knowledge	16%
Not enough knowledge/confidence	16%
Not enough time/knowledge/confidence	8%
How can we assist you with your inhaler technique? (please circle all that are applicable)	
In-services	80%
Providing resources such as handouts, placebos, YouTube videos	76%
Conducting inhaler technique competency assessment	64%
Online training package to be completed	64%
If you circled in-services, how often would like them?	
Fortnightly	12%
Monthly	28%
6 Monthly	36%
Yearly	4%
Not applicable (did not circle 'in-services')	20%
If you circled providing resources, which resources would you like? (please circle all that are applicable)	
DVD/YouTube videos (for patients)	52%
Placebos	36%
Handouts (inhaler instructions)	48%
Not applicable (did not circle 'Resources')	24%
If you circled competency assessments, how often would like them done?	
6th monthly	16%
Yearly	44%
Second yearly	4%
Not applicable (did not circle 'competency assessments')	36%
If you circled online training package, how often should it be completed?	
Yearly	64%
Second yearly	0%
One off	0%
Not applicable (did not circle 'online training package')	36%

second tertile had between 3 and 8 years of experience (n = 9), and the third tertile had more than 8 years of experience (n = 8).

Pre-inhaler assessment survey

Most participants in this cohort reported their confidence in providing inhaler education to patients as 'moderate' (76%) or 'extremely high' (8%). Only 16% reported that they were 'not confident' (Table 1).

Almost all participants (96%) agreed that patients should be supervised when taking inhaled medication and 92% felt this was the responsibility of all nurses. More than half of the participants (60%) stated that inhaler education/supervision should be attended each time a patient was taking a dose of their inhaled medication. Almost two-thirds (64%) felt their ward had sufficient educational resources to equip them with good knowledge and understanding of inhaler technique. Details of responses to assistance with inhaler technique education can be found in Table 1.

Major barriers to providing inhaler education to patients were reported as 'not enough time' and 'not enough knowledge', while 'not enough confidence' was not a major barrier in general (Table 1).

Inhaler competency assessment

None of the participants could correctly perform all of the steps of use for all eight inhaler devices tested. Participants demonstrated greatest competence with

Table 2. Inhaler device score.

Inhaler Device Score	Mean score % (SD)	Prescriptions in 2015 (% total)
Metered dose inhaler (pMDI)	73 (22)	10136 (54.0%)
Handihaler	72 (27)	2191 (11.7%)
Breezhaler	62 (32)	4286 (22.8%)
Turbuhaler	50 (30)	1368 (7.3%)
Accuhaler	43 (30)	740 (3.9%)
Genuair	40 (35)	33 (0.2%)
Ellipta	38 (30)	25 (0.1%)
Respimat	1 (4)	N/A
Total	**47 (17)**	18779 (100%)

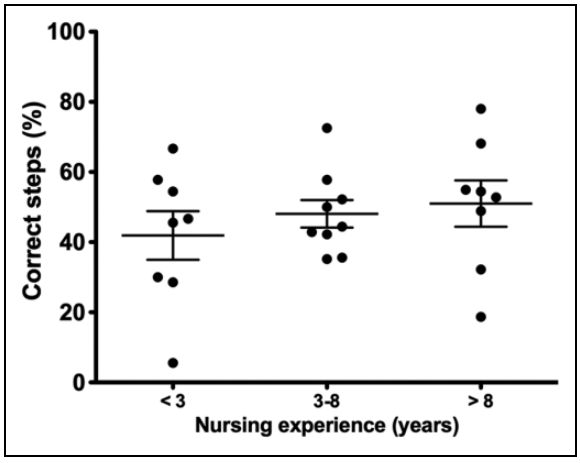

Figure 1. Correct steps % (all devices) arranged by tertiles of nursing experience. Each dot represents an individual participant. Horizontal bars show summary data displayed as mean ± SD. There was no significant difference between tertiles ($p = 0.55$).

pressurised metered dose inhaler (pMDI) and spacer device with a mean total score of 73 ± 22% and Handihaler with a mean total score of 72 ± 27%. The lowest score was recorded with the Respimat device with a mean total score of 1 ± 4% (Table 2). The combined average score for demonstrating correct steps for all the eight devices was 47 ± 17% (Table 2). There was no correlation between percent correct steps (all devices) and years in nursing ($r = 0.21$, $p = 0.31$), or between percent correct steps and degree of confidence ($r = 0.02$, $p = 0.91$). Although the percentage of correct steps (all devices) increased with higher nursing experience tertiles with the Clinical Nurse Specialists and Educator also being in the highest tertile, there was no statistically significant difference between the tertiles ($p = 0.55$; Figure 1).

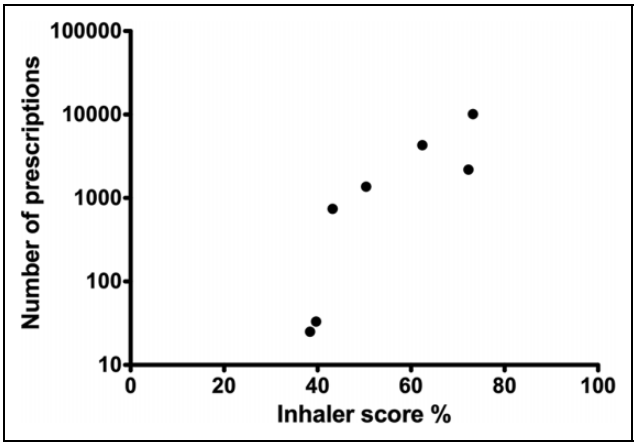

Figure 2. Inhaler score (%) plotted against number of individual hospital inhaler prescriptions in 2015. Each dot represents an individual inhaler device. Number of prescriptions is displayed on a logarithmic scale. There was a strong correlation between inhaler score and number of prescriptions ($r = 0.78$, $p = 0.039$).

Hospital inhaler device usage

18779 inhalers for treatment of airways disease were dispensed/distributed for inpatient use in 2015 (i.e. the year prior to the study; Table 2). The pMDI device was the most common inhaler used (54%), followed by Breezhaler (23%) and Handihaler (12%). The least prescribed inhalers were Genuair (0.2%) and Ellipta (0.1%). The Respimat device was not on the hospital formulary; therefore no hospital data regarding use was available. There was a strong correlation between number of inhalers prescribed in the previous year and the nurses' inhaler device score ($r = 0.78$; $p = 0.039$; Figure 2).

Discussion

Despite reporting overall moderate to high confidence with providing inhaler education to patients as a group, the group mean score for competence with using 8 different inhaler devices was less than 50% for nurses working in a specialised respiratory inpatient unit at a quaternary teaching hospital. Most participants (84%) rated their confidence in teaching inhaler technique as 'moderately confident' to 'extremely confident', however none of the participants were able to demonstrate the correct steps of use for all of the inhalers provided. Our study involved nurses only but inhaler errors are widespread among a diverse range of health care professionals (HCPs) as shown by a recent systematic review in

which inhalation technique was correct in only 15.5% of cases.[15] Given inhaler technique has been identified as one of the most important elements in managing airway disease, it is critical to ensure HCPs providing inhaler education to patients are competent in the steps to use each inhaler device, as a first step to teaching effective inhaler technique.

Many prior studies have reviewed inhaler technique for nurses working in a wide variety of departments including medical, respiratory, intensive care, emergency, and community settings, and other HCPs such as pharmacists, doctors and respiratory therapists.[16,20,21] However, to our knowledge, this study is the first that has examined the relationships between the total correct device steps, years of nursing, self-reported confidence and total hospital-prescribed inhaler device in nurses from a specialised respiratory ward. The lack of correlation between correct technique and years of experience or confidence suggests a need to improve the inhaler competence of all nursing staff with a particular focus on training for newer and/or less often prescribed inhaler devices to improve patient care, irrespective of nurses' perceived confidence in inhaler technique or their level of nursing experience. Although knowledge of correct inhaler technique is important to all HCPs treating patients with respiratory diseases, it is essential for respiratory nurses and HCPs working in a specialised respiratory inpatient unit treating the most vulnerable patients who have been admitted for their airways disease, in order to reduce the risk of avoidable readmissions.

Almost two-thirds of participants felt the ward had sufficient educational resources to equip them with adequate knowledge and understanding of correct inhaler technique, but this was not reflected by their overall competency assessment scores. The strong correlation between the number of each inhaler prescribed in the hospital in the 12 months prior to the study and the respective inhaler competency score suggests that a training focus on inhalers which are less commonly prescribed to inpatients may be important. Initiatives to improve inhaler technique for HCPs as well as patients can be delivered through interventions including workshops[22] and teaching sessions,[23] interactive computer programs[24] and serious games,[25] training tools for inhalational devices,[26] printed instructional materials and videos,[27] and internet-based tutorials.[28] When considering educational resources to be used in inhaler training including videos and printed instructional materials, it is essential that they have met appropriate quality standards to ensure accurate information; for example, we used nationwide resources through the Lung Foundation Australia.

Our study suggests that nurses need to be more self-aware of their practice and take responsibility for maintaining competence with inhaler device technique through regular training and competency assessments which allows them to retain and refresh their knowledge and skills. Regular ward-based inhaler educational training sessions by an expert may be required to optimise inhaler technique, especially the less commonly encountered inhalers, rather than optional educational sessions or self-directed ad-hoc learning. Periodic competency assessments for inhaler technique may help to identify deficits where further education may be required. Regularly practicing correctly taught techniques to patients may be a valuable way to maintain and consolidate skills as shown by an effective intervention among community pharmacists.[29] This may be effective in maintaining inhaler technique for commonly used devices but may not improve technique for less commonly used inhalers. Therefore additional means of maintaining knowledge of less commonly prescribed inhalers may be required.

Although our findings are based on nursing inhaler technique assessment on one occasion (i.e. cross-sectional study), it is important to note that mastery at a particular point in time does not necessarily equate with continued competence in the future.[17,26] Further research is required in finding effective strategies which allow nurses to learn and sustain inhaler technique skills and knowledge and the 'overview, teach and review' principle that was successfully applied in community pharmacists could also be considered for respiratory nurses[29]; however it would be important to review which strategies would be most acceptable and effective in learning and maintaining inhaler technique skills in a busy acute care environment. This may have particular relevance for less often encountered devices, and different strategies may be needed for these as infrequent exposure may lead to a faster deterioration in skills. Understanding the attitudes of nurses to inhaler education, assessing currently available educational materials, and the most effective means to assess, maintain and monitor inhaler technique competence should be further explored.

There are several limitations to our study. Firstly, recruitment of participants into the study may have been hindered by potential participants' familiarity

with the researchers from their everyday interaction in the respiratory department that may have resulted in volunteer bias. Secondly, we are unable to exclude the possibility that nurses who had already been assessed may have disclosed the study methodology to colleagues, particularly the need to demonstrate the use of inhalers, allowing nurses to practice prior to assessment which may have altered the true competence of the nurses prior to the study. Thirdly there was only a relatively short time for the nursing staff to become familiar with the Respimat device which was first listed for treatment for COPD in Australia 6 months prior to the study, which is likely to have accounted for the very low competency with this device. Our study did not address the important issue of critical errors in inhaler technique and we recognise that each erroneous inhaler step may not result in an equivalent impairment in drug delivery; however we took the view that each correct step in inhaler use was essential to the optimal delivery of medication and therefore weighted each step equally. Additionally, there is no consensus regarding which steps are or are not 'critical'. Finally, we assessed the nurses' own inhaler techniques as a surrogate measure of their competence in assessing patients' inhaler technique. While competence in inhaler technique is a necessary prerequisite to teaching the use of inhalers, we appreciate that the process of teaching patients to use their inhaler correctly is clearly a more complex procedure as it also involves effective delivery of information. Furthermore the survey question 'How confident do you feel on educating patients on their inhaler medications' may be associated with many factors that relate to 'confidence' in educating patients on inhalers including level of nursing experience, education, and mastery of English. In addition, participants may not necessarily be competent with their own inhaler use, but may feel more confident in their ability to talk with patients and to educate them. Finally, our investigator-developed survey was not tested for reliability or validity; therefore we cannot be sure that it has measured the construct of inhaler confidence.

Conclusion

Despite reporting a moderate to high degree of confidence in educating patients on inhalers, respiratory nurses demonstrated significant deficits in using inhaler devices, in spite of the importance that this group had placed on observing and correcting patients' inhaler techniques. Correct inhaler technique correlated strongly with the number of prescriptions of each device in the hospital, but was unrelated to the overall level of nursing experience or confidence in educating patients on device technique. Future studies exploring the most effective educational intervention(s) for delivering inhaler education to respiratory nurses, which develops and maintains their knowledge of correct inhaler technique, will be important in improving their competency in educating patients about the correct use of inhaled respiratory therapies.

Author contributions

V Swami and M Roberts made substantial contributions to the conception and design of the work, and were involved in data acquisition, drafting and revising of the manuscript. J-G Cho was involved with data analysis, and in the drafting and revising of the manuscript. All authors were involved with interpretation of data for the work, drafting of the manuscript, and approved of the final version to be published and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Data accessibility statement

Underlying research materials related to the paper can be accessed by contacting the authors.

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Supplemental material

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